

APPENDIX (as Supplementary supporting material, no need for Review requirement)

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The report this Appendix is attached to documents that the surface area of Earth has been doubled for topography, terrain and soil rugosity – thus Life on Earth is also doubled. It also provides a solution to Climate Change, Extinctions, and causes of human Cancer. This is being modest... the actual surface area of Earth is likely tripled or quadrupled, and most of the other causes of species' extinction and human ill-health are also resolved through Soils. Here more insight is provided into institutional deficiencies and policy biases as the main cause of our failure to fix many of the problems from human excesses.

Institutional Bias and Soil Oversight

The 2,409-page IPCC (2021) report is highly biased as “Ocean” is cited 7,337 times but “Soil” only gets 1,061 hits, or just one seventh, this despite soils being key to climate and food. “Land” gets about half the number of hits as Ocean at 4,428, but Land is arguably a thousand times more relevant and important in terms of carbon cycle, biodiversity and food security. IPCC references “soil organic carbon” just five times, while there are whole chapters on spurious “Ocean Acidification”. Soil acidification is not mentioned at all.

The IPCC team had 198 Coordinating Lead Authors, 36 Review Editors (total 234) with an additional 615 Contributing Authors (total 850). Of these, several belong to major Marine, Meteorological or Atmospheric Institutes, but I cannot find anyone affiliated with a dedicated Soil Ecology Institute. This is hardly surprising as none exists anywhere.

A search Overview says: *“There is no single “soil ecology research institute” but many research groups and institutions worldwide that focus on the subject, such as the National Centre for Soil Ecology (NCSE) in the Netherlands, a **virtual platform** which connects Dutch soil ecologists, and the Institute of Soil Biology and Biogeochemistry in the Czech Republic. Other examples include the James Hutton Institute in the UK, the [ZHAW Institute of Natural Resource Sciences](#) in Switzerland, and the Soil Ecology and Ecotoxicology Lab at the [University of Coimbra \(CFE\)](#) in Portugal.”* None of these compete in the scale and staffing of the many Marine facilities. This deficiency, or rather disparity, needs to be urgently addressed with proper priority and resource reallocation.

Bias is not only with IPCC, it is much more pernicious. As another example, ESSD 2025 - <https://essd.copernicus.org/articles/17/965/2025/essd-17->

[965-2025.pdf](#) cites Ocean 450 times but Soil only gets a dozen mentions while, of the 88 institutions the authors are affiliated with, not one has mention of Soil in their title. Surely time for a “Sea Change”.

There is no shame in making honest errors in Science, but there is in failing to correct them. Throughout this report there are blatant omissions in reporting the importance of soil. Also clearly shown is how relatively immaterial are the boasted glories of Oceans.

Justification for Marine research usually involves hackneyed claims that Ocean occupies 70% of the Earth's surface (truly just about 30% when terrain is properly considered), has up to 90% of biodiversity (truly 0.001% or less), provides food for half the world (actually 1%) and, most perverse, that Ocean supplies 50-85% of daily oxygen we need to breathe. In the same breath, Marine researchers, without irony, will claim the Ocean is becoming anoxic due partly to catastrophic acidification that will dissolve the precious coral reefs.

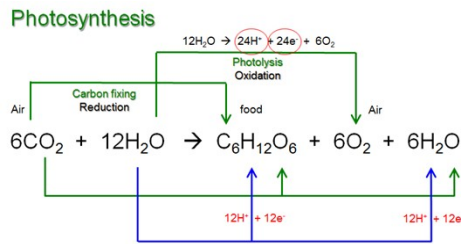
It is difficult to fathom why these falsehoods are widely accepted without challenge. Especially lapse are the few soil researchers who from cursory study know marine claims are quite false. Yet they do not feel obliged to speak out to correct these errors. Why not?

Fossil Fuel Fallacy

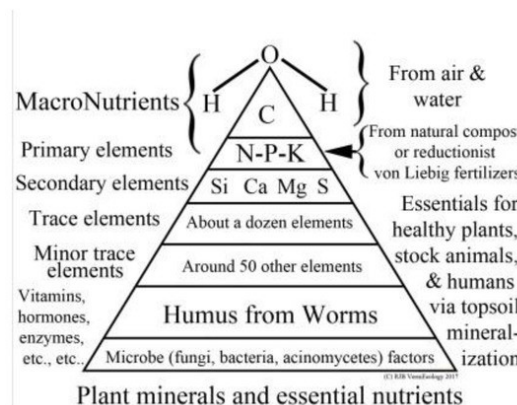
Deforestation is not directly related to net carbon loss to the atmosphere, it is the accompanying depletion of the litter layer and topsoil, and eventually subsoils, to decomposition and erosion that does. Rothamsted's Broadbalk Wilderness shows that immediate release of carbon due to felling of above-ground trees and other vegetation – most incinerated – which is shortly followed by greater than 50% loss of topsoil carbon. This then is the major source of atmospheric CO₂, both historically and currently. The argument by IPCC that the reduced proportion of ancient carbon isotopes demonstrates this is ancient carbon, i.e., fossil fuel sources, is misconstrued. Ancient soils, some thousands or millions of years old, are similarly depleted in these isotopes. Q.E.D.

Failures of Scientific Enquiry

A starting point is with the basics of Life on Earth dependent upon Photosynthesis.



Requirements are for atmospheric CO_2 , soil based freshwater H_2O , and sunlight, all three of which are sufficient and freely available. Those attempting to add fertilizers to this must accept that Evolution is based upon these essentials being in gaseous form (CO_2 in the atmosphere), liquid (in rainfall) and in commodious range of solar insolation; all being “just right” under our planetary range of temperatures, pressures and irradiation. However, for photosynthetic plants to grow and reproduce and evolve, they rely entirely upon the Soil that has abundant supplies of essential nutrient stores. Is this also freely available? It is taken for granted, but Soil as the basis supporting all Life on Earth is dying.



Basic photosynthesis equation shows CO_2 is source of all organic carbon, not humus. Whereas terrestrial plants take in and recycle the entire atmospheric stock within two years, marine plants use $\sim 40 \text{ Gt C/yr}$ (from about 700 Gt C ?) of dissolved CO_2 thus are not directly involved in active uptake nor direct recycling of atmospheric carbon dioxide.

Balanced stoichiometry for respiration and combustion (decomposition/fire) is the reverse: $\text{C}_6\text{H}_{12}\text{O}_6 + 6\text{O}_2 \rightarrow 6\text{CO}_2 + 6\text{H}_2\text{O}$, using O_2 and recycling CO_2 and water/steam.

Ecology is defined as the interaction between living organisms and their environment, both vital and inert (i.e., biological, physical or chemical). Biology is thus part of Ecology. Biological symbioses and antagonisms are a fundamental part of Ecology, as are plant and animal behaviours, while chemistry is of lesser concern. Farming is ecological too.

Unfortunately, most academic agronomists and agrichemical representatives promote agriculture as a mere chemical enterprise, yet the growing of crops is entirely ecological, much more complex than a few simple elemental reactions. Agricultural colleges typically conduct chemical or GMO trials using single plants in a soil that is sterilized (usually with chemicals or heat) in order to avoid the inconvenience of natural biological variation, for example the presence in a pot or a plot of a worm. The results of the treatment effects are then reported compared to the controls as if this is the definitive outcome. In reality, the ecological complexities of Nature are often outside the remit or realization of such narrow confines of a mere chemist or biochemical “engineer”. Proper and practical ecological outcomes may be better sought on adjacent fields on operational farms under different regimes, such as full chemical versus 100% organic. A summary of such side-by-side farm situations is reported on by Blakemore (2018a).

Possibly a pivotal point in the divergence of ecological from chemical farming was around 1881-1885, when Darwin (1881) published the first Soil Ecological study, and Frank (1885) published work on mycorrhizae. In contrast, Lawes & Gilbert (1885) argument for artificial manures (viz. Superphosphate synthetic fertilizer) that were established at Rothamsted. The importance of Frank’s work was almost entirely forgotten and swamped by the simplistic N-P-K chemical solutions on offer, yet may ultimately prevail with the most recent biological understanding of plant-microbe symbioses e.g. studies by Dent & Cocking (2017) argue that enhanced N-fixation may reduce the need for N fertilizers. And the arguments go back even further to Darwin (1836) and von Liebig (1840) and the humus theory of Jethro Tull [which incidentally is proving to be closer to the true situation since, seemingly, “90 or so minerals in the soil are essential” (Thomas, 2007)]. These nutrients are naturally supplied to plants at correct rates, in correct locations, and at the right times, i.e., via natural biological activities – as Howard (1945) and Balfour (1975, 1977) explain. The rhythms of nature are seen in the fluxes of components such as simplistic N-P-K here:

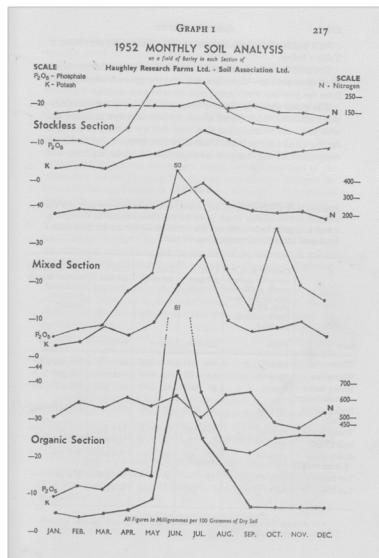


Image from <https://vermecology.wordpress.com/2017/05/27/slimeless-spring-ii/> ; <https://vermecology.wordpress.com/2020/10/16/nitrogen-necrosis/> and <https://vermecology.wordpress.com/2022/05/04/worms-in-the-palace/>. Note that seasonal fluctuations, especially of Phosphates, makes random spot samples pointless. Also, up to 80% of P and 20% of nitrogen transferred to plants via mycorrhizal pathways.

Similar seasonal or climatic fluctuations (temperature, rain) apply to levels of carbon, moisture, microbial activity, bulk density and various other key soil metrics (e.g., <https://www.ars.usda.gov/ARSUserFiles/6233/seasonalVariationInSoilOrganic.pdf>).

As concerning is that some Agricultural institutions conduct comparative trials, as with Rothamsted, on small plots that are unrepresentative of whole-farm organic practices. Such unrealistic treatments are likely the “tokenism” destined to fail, nevertheless the results are published as definitively demonstrating the inferiority of organic practices.

Most often such highly biased research is funded by the chemical companies, directly or indirectly, thus it is in their profit interest to denigrate composts that are freely available to anyone, and the earthworm that is highly beneficial but unpatentable. For real progress, scientific researchers need honesty, independent of venal interests.

Government Policy and Public Funding

Policy needs are, firstly, for open and honest scientific reporting and critical analysis of factual soil and biotic baseline data and any changes in these along with practical and beneficial remedies. This implies a need for independent researchers without commercial or other vested interests. A model for this is in the many Marine research facilities mostly having

government support. With the proper context and urgency of triage, as in the current report, there is an imperative to redirect funding appropriately.

In this way the establishment of essential Soil Ecology Institutes would be cost free and, moreover, would be of real benefit to the taxpaying funders in terms of natural health.

There is concomitant need to demand 100% organic food as it is now well established that the continued poisoning of the environment with artificial and toxic chemicals is immoral and suicidal. The trope that more food is needed and this is only achievable with yet more synthetic input is false when the true yields, nutrient content and environmental benefits of natural food are properly studied and reported independently.

Government subsidies removed from agrichemical and meat producers can similarly be re-directed to organic producers. This may involve encouraging of domestic and municipal composting. Trucks delivering food to cities should return to the farms with the market left-overs and other food or garden wastes for recycling via composts. Commercial entities and the companies responsible for deforestation, poisoning of the environment and food should recompense. At present the polluters often do not pay.

The argument that because organic farmers' fields already have increased soil carbon and higher biodiversity they should not be entitled to carbon credits or other beneficial incentives as paid to Regen farmers need to be reevaluated. More properly, organic farmers or Permaculture practitioners may be held as deserving models for emulation and instruction to those farmers in transition or to rehabilitate chemical farmers.

Over-expenditure on Ocean

It is undeniable that coral reefs are interesting with great diversity, for an Ocean habitat, but they cannot be argued to have much value to fisheries (providing less than 1% of human food), nor threat of extinction since no coral is yet reported extinct. Moreover, the justification for massive government subsidies for their research seem misplaced. For example, the Great Barrier Reef in NE Australia has received \$billions in funding starting from 1960s. How much of this has gone towards supporting sugarcane farmers to convert to organic to help fix the reefs' pollution problems? The State of Queensland has around 350,000 ha of land used to provide 95% of Australia's sugarcane, and just a tiny fraction of 55 ha operated by Bundaberg Sugar is certified organic or in conversion as of early 2024, on currently available information. Yet a preliminary study in 2013 found that organic sugar cane in Philippines had higher yields, more carbon and much greater soil biodiversity than conventional, chemical neighbours (Blakemore 2016, 2018). Rational argument is that supporting organic

growers, rather than yet more marine misinformation, resolves soil issues whence the problems of the Sea mainly originate.

From 2000 to 2010 a \$1 billion Census of Marine Life project determined that there are only 230,000 organisms in all Oceans, including microbial life, and speculated a total of 2 million. Thus, a similar diversity to all the World's Oceans may be found in a handful of healthy soil. Yet there is very little support for soil biodiversity such as earthworm research compared, for example, to fully supported Polychaeta marine worm research that is of zero benefit thus must be exceedingly difficult to justify the expense and effort in a time of multiple crises. Such rationale and funding disparity needs correction, not least for self-preservation concerns of Climate, Food and the extensive extinction of Soil.

Support for the coral reef is predicated on the main claim that climate change is the major problem which may result is sea level rise and warmer waters – despite corals relying on both of these – while mainly failing to accept that any chance to address climate or pollution can only be achieved by fixing the Soil, on land and on farms or in our food. The Table below shows how Context and Triage are essential for making rational choices.

Table A1. Summary of Disparities in Relative Importance of the Major Realms of Life: viz. Land/Soil, Ocean and Freshwater, often misrepresented as having equal merit.

Ecological Realm Metric	Soil/Land (% of total)	Ocean	Freshwater
Earth's surface area (+ terrain) Gha	64 Gha (~65%)	36 (~35%)	0.5 (~1%)
Biodiversity/Species totals	~2.1x 10 ²⁴ (>99.9%)	10 ¹⁰	<10 ¹⁰
Total species known (Spp % Approx)	<0.00001%	>10%	~70%?
Extinctions on IUCN Redlist Spp	>910 (>90%)	2-4 (0.2%)	~100 (9%)
Living Biomass/Carbon Gt C	~2,500 (>99%)	3	0.3?
Living Phytomass/Carbon Gt C	~2,400 (>99.9%)	0.08	0.08?
Organic carbon store Gt C	30,000 (>90%)	<1,000	2,500 (soil)
Productivity NPP Gt C/yr	220-270 (~90%)	15-30	1.3
Human food Calories %	>98%	>1.5%	<1.5%
Freshwater store %	>70%	0%	<30%
O2 release from NPP/yr %	>99%	0-1%	<1%
Antibiotic/Anticancer/Drugs source	>50-60%	<0.1%	?
Ecological Services value	150 (>98%)	3	<0.3?

\$T/yr (%)			
Floods/Fires, etc. events/yr (%)	>400 (100%)	-	-
Urban/infrastructure area %	~1-2%	-	-
Agriculture (on habitable area) %	~50%	-	-
Land/soil degraded by humans	30-66% (33% prime)	-	-
Organically farmed area	1-2%	-	-
Recent Acidification pH (% change)	-0.24 - 2.0 (>10,000%)	-0.1 (30%)	-0.3 (90%)
Plastic pollution Mt/yr	82 (>90%)	1.7 (0.5%)	7 (9%)
Dedicated Eco Research Institutes	0 (0%)	~900	90
Ecological Research funding \$ \$/yr	1%?	90%?	9%?

Information in this Table may be sourced or checked; comments/corrections welcomed.